

# State-of-the-art, Multi-Fidelity Modeling and Simulation (M&S) Tool for Nonlinear Aeroelasticity, Phase II

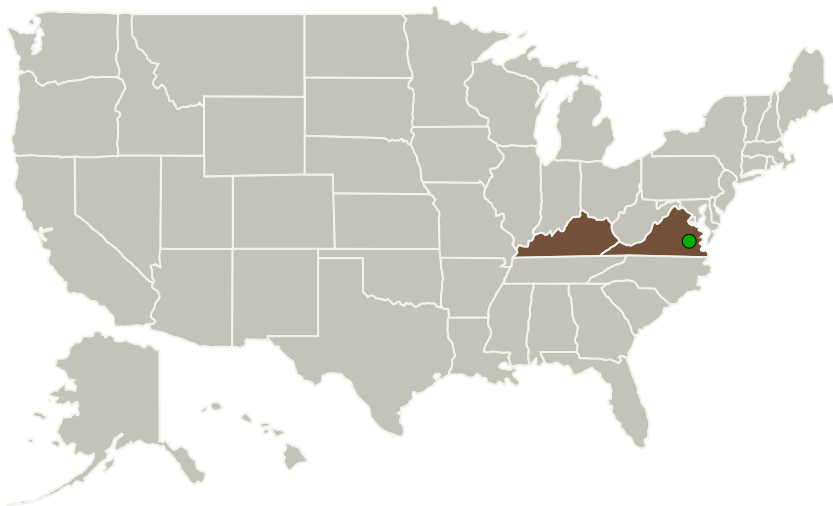
Completed Technology Project (2011 - 2013)



## Project Introduction

Research is proposed for the development of a state-of-the-art computational aeroelastic tool. This tool will include various levels of fidelity and the ability to perform computational uncertainty quantification for data-driven risk analysis and certification. A number of novel reduced-order in time methods will be implemented into the code allowing for efficient and accurate aeroelastic simulation which will enable both the exploration of complex physics, point design and fast generation of "training data" for reduced order spatial aeroelastic models. The various levels of fidelity available in the code for aeroelastic modeling will range from CFD-based (both grid-based and a novel particle-based method) simulation to reduced-order aeroelastic models based upon Volterra series representations and Proper Orthogonal Decomposition (POD). The application of the proposed innovations spans the range of flight, from high-speed transport vehicles, to small-scale, flapping Micro-Air vehicles. Anticipated results include 1) the further validation and implementation of the proposed novel time-reduced order models into the existing ASTE-P solver framework (which already includes the various level fidelity mentioned above), 2) application of the proposed work to large-scale simulation and comparison with experiment, and 3) advancement of the state of knowledge for nonlinear problems in aeroelasticity in both the subsonic, low Reynolds number regime and transonic high Reynolds number regime.

## Primary U.S. Work Locations and Key Partners



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Organizations Performing Work	Role	Type	Location
Advanced Dynamics, Inc.	Lead Organization	Industry Minority-Owned Business	Lexington, Kentucky
● Langley Research Center(LaRC)	Supporting Organization	NASA Center	Hampton, Virginia

## Primary U.S. Work Locations

Kentucky	Virginia
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## Project Transitions

**June 2011:** Project Start**May 2013:** Closed out**Closeout Documentation:**

- Final Summary Chart(<https://techport.nasa.gov/file/139491>)

## Organizational Responsibility

**Responsible Mission Directorate:**

Space Technology Mission Directorate (STMD)

**Lead Organization:**

Advanced Dynamics, Inc.

**Responsible Program:**

Small Business Innovation Research/Small Business Tech Transfer

## Project Management

**Program Director:**

Jason L Kessler

**Program Manager:**

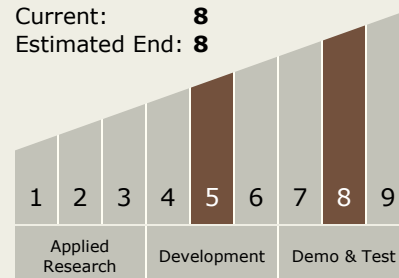
Carlos Torrez

**Principal Investigator:**

Patrick Hu

## Technology Maturity (TRL)

Start: 5  
 Current: 8  
 Estimated End: 8



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### Technology Areas

#### Primary:

- TX15 Flight Vehicle Systems
  - └ TX15.1 Aerosciences
    - └ TX15.1.3 Aeroelasticity

### Target Destinations

The Sun, Earth, The Moon,  
Mars, Others Inside the Solar  
System, Outside the Solar  
System